

CLAIMS

1. For use in an optical carrier strength monitor, an apparatus to process a plurality of spatially-separated, data-modulated carriers of a wavelength-division multiplexed (WDM) signal, comprising:
  - 5 a plurality of optical modulators arranged so that each receives a corresponding one of the plurality of data-modulated carriers; and
  - 10 a control module adapted to actuate at least one of the plurality of optical modulators such that a carrier identifier is applied to at least one of the plurality of carriers, whereby the at least one of the plurality of data-modulated carriers is modulated with data and a carrier identifier.
- 15 2. The apparatus of claim 1, further comprising a demultiplexer configured to receive the WDM signal and form the plurality of spatially-separated carriers.
- 20 3. The apparatus of claim 1, further comprising a multiplexer configured to receive the spatially-separated carriers from the outputs of the plurality of optical modulators and to combine the spatially-separated carriers to form a second WDM signal.
- 25 4. The apparatus of claim 3, further comprising:
  - an optical tap optically coupled to the multiplexer output and arranged to tap a portion of the second WDM signal; and
  - 25 a photosensor to transduce the tapped portion of the second WDM signal and form a transduced signal; and
  - 30 a strength calculation module configured to receive the transduced signal and to calculate the strength of the at least one of the plurality of carriers.
5. The apparatus of claim 4, wherein the strength calculation module comprises a rectifier and an integrator that together determine the strength of the at least one of the plurality of carriers.

6. The apparatus of claim 5, wherein the strength calculation module further comprises a bandpass filter to selectively pass a portion of the transduced signal corresponding to the carrier identifier, and to provide the portion of the transduced signal to the rectifier.  
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7. The apparatus of claim 1, wherein the modulators are comprised of actuatable grating elements of a diffraction grating.  
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8. The apparatus of claim 7, wherein the diffraction grating is a diffraction grating of a dynamic channel equalizer.  
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9. The apparatus of claim 8, wherein the control module applies the carrier identifier to only a selected one the plurality of data-modulated carriers during a selected time interval.  
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10. The apparatus of claim 9, wherein the control module controls each of the plurality of modulators with a corresponding electronic signal having a DC component, and a selected one of the plurality of modulators corresponding to the selected one of the plurality of carriers with an AC component to apply the carrier identifier, whereby the channels are equalized and the selected one of the plurality of carriers is modulated.  
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11. For use in an optical carrier strength monitor, an apparatus for processing a plurality of spatially-separated, data-modulated carriers of a wavelength-division multiplexed (WDM) signal, comprising:
  - a plurality of optical modulators arranged so that each receives a corresponding one of the plurality of data-modulated carriers; and
  - a control module adapted to modulate only a selected subset of the plurality of optical modulators during a given time interval, so as to apply a corresponding carrier  
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identifier to each of a subset of the plurality of data-modulated carriers, whereby each of the subset of carriers is modulated with data and a carrier identifier.

12. The system of claim 11, wherein the selected subset of the plurality of optical  
5 modulators consists of only one of the optical modulators.

13. The system of claim 11, further comprising a spectral demultiplexer  
configured to receive the WDM signal and form the plurality of spatially separated  
carriers.

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14. The system of claim 12, wherein the control module is adapted to modulate at  
least two of the plurality of modulators to apply a common carrier identifier to each of  
a corresponding at least two of the plurality of carriers, application of the common  
identifier to a first of the at least two of the plurality of carriers and a second of the at  
15 least two of the plurality of carriers occurring sequentially.

15. For use in an optical carrier strength monitor, an apparatus for processing a  
plurality of spatially-separated carriers of a wavelength-division multiplexed (WDM)  
signal, comprising:

20 a plurality of optical modulators, each arranged to receive a corresponding one  
of the plurality of spatially-separated carriers; and  
a control module adapted to control a first of the plurality of optical  
modulators to apply a carrier identifier to a first of the plurality of the carriers, and to  
control a second of the plurality of optical modulators to apply the carrier identifier to  
25 a second of the plurality of the optical carriers, the modulation of the first of the  
plurality of optical modulators and the second of the plurality of modulators being  
applied sequentially.

16. The apparatus of claim 15, further comprising a demultiplexer configured to  
30 receive the WDM signal and form the spatially-separated carriers.

17. The apparatus of claim 16, further comprising a multiplexer configured to receive the spatially-separated carriers from the outputs of the plurality of optical modulators and to combine the spatially-separated carriers to form a second WDM signal.

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18. The apparatus of claim 17, further comprising: an optical tap optically coupled to the multiplexer output and arranged to tap a portion of the second WDM signal; a photosensor to transduce the tapped portion of the second WDM signal; and a strength calculation module configured to receive the transduced signal of the second WDM signal and to calculate the strength of the at least one of the plurality of carriers.

19. The apparatus of claim 18, wherein the strength calculation module comprises a rectifier and an integrator to calculate the strength of the at least one of the plurality of carriers.

20. The apparatus of claim 17, wherein the strength calculation module further comprises a bandpass filter to selectively pass a portion of the transduced signal corresponding to the carrier identifier, and to provide the portion of the transduced signal to the rectifier.

21. A method of processing at least one data-modulated carrier of a wavelength-division multiplexed (WDM) signal including a plurality of data-modulated carriers, comprising a step of:

25 modulating the at least one of a plurality of data-modulated carriers with a carrier identifier, the plurality of data-modulated carriers being spatially separated.

22. The method of claim 21, further comprising a step of spatially-separating the plurality of data-modulated carriers prior to the step of modulating.

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23. The method of claim 21, further comprising steps of:

multiplexing the plurality of data-modulated carriers to form a second wavelength-division multiplexed (WDM) signal;

tapping a portion of the second WDM signal;

transducing the portion to form an electronic signal; and

5 calculating an output indicative of the strength of the at least one of the plurality of data-modulated carriers by processing the electronic signal.

24. The method of claim 23, wherein the step of calculating an output comprises rectifying the electronic signal.

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25. The method of claim 24, wherein the step of calculating an output further comprises integrating the rectified electronic signal.

26. The method of claim 21, wherein the step of modulating comprises

15 modulating a diffraction grating.

27. The method of claim 26, wherein the diffraction grating is a component of a dynamic channel equalizer.

20 28. A method of measuring the strength of one of a plurality of carriers comprising a wavelength-division multiplexed (WDM) signal, using a dynamic channel equalizer (DCE) including a plurality of actuatable elements, comprising steps of:

25 equalizing the strengths of the plurality of carriers by actuating at least one of the plurality of actuatable elements; and

modulating the one of the plurality of carriers with a carrier identifier.

29. The method of claim 28, further comprising a step of demultiplexing the plurality of carriers to spatially separate the plurality of carriers prior to the step of 30 equalizing and the step of modulating.

30. The method of claim 28, further comprising a step of multiplexing the plurality of plurality of carriers to from a wavelength-division multiplexed (WDM) signal, the step of multiplexing occurring after the step of equalizing and the step of modulating.

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31. The method of claim 28, wherein the step of equalizing and the step of modulating are achieved at the same time by actuating the grating elements of a diffraction grating.

10 32. The method of claim 30, further comprising a step of tapping a portion of the WDM signal, and a step of transducing the tapped portion to form an electronic signal, the step of tapping and the step of transducing occurring after the step of tapping.

15 33. The method of claim 32, further comprising a step of calculating an output indicative of the strength of the one of the plurality of carriers by processing the electronic signal.

20 34. The method of claim 33, wherein the step of calculating comprises a step of rectifying the electronic signal and a step of integrating the rectified signal.